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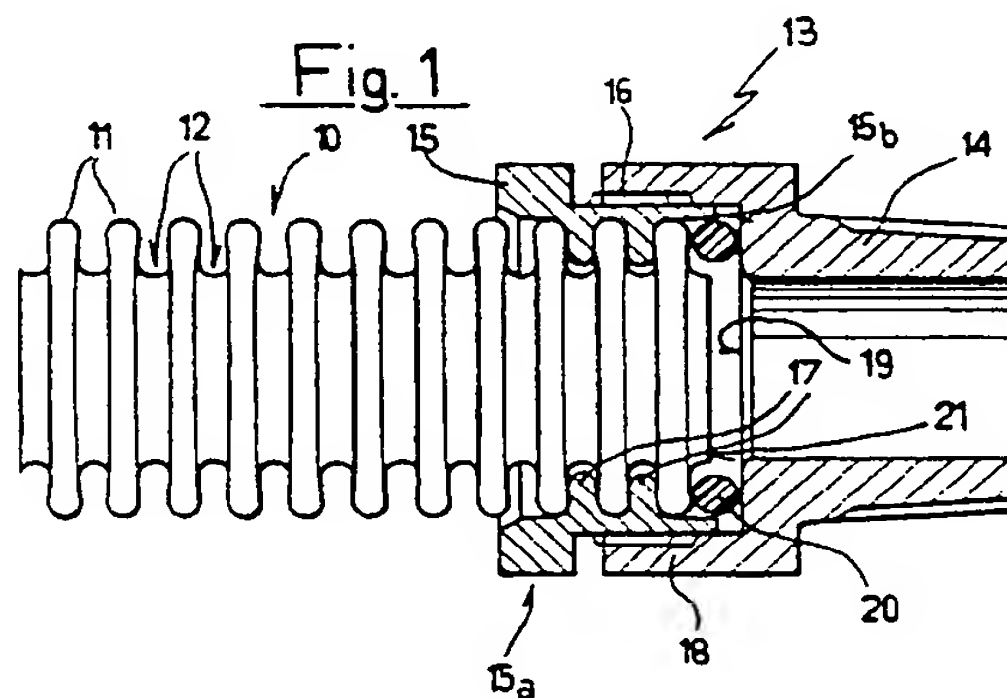
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I-20123 Milan (IT)(54) **Sealing quick-coupling device for unbraided flexible metal tubes.**

(57) The device comprises a sleeve (14) which can be associated with the rigid tube or union, and at least one ring (15) which can be associated with the flexible tube, a threaded coupling (16) on the sleeve and the ring to mutually connect them and force them axially against each other, a series of annular protrusions (17) which are associated with the ring and protrude radially toward the axis of the ring to engage respective grooves (12) which separate corresponding undulations (11) of the flexible tube and to push the undulated flexible tube into forced contact engagement against the sleeve when the threaded coupling is tightened by turning the ring (15) with respect to the sleeve (14); the annular protrusions (17) associated with the ring have a profile which is complementary to the profile of the grooves which separate the undulations of the flexible tube.



The present invention relates to a sealing and weld-free quick-coupling device for flexible metal tubes of the type with parallel or helical undulations.

The coupling of metal tubes of the specified type to other rigid pipes, unions and the like is difficult because of the presence of the undulations, which, by deforming, do not allow for axially forcing the undulated tube against the sealing gaskets which abut on the rigid pipe or on the connecting union.

In order to avoid this problem, it has been suggested to use unions in which a movable bush, pulled by a ring, which is screwed on a connecting sleeve, acts with a protruding ring, which is engaged in a groove of the undulated tube so as to compress a series of undulations, generally the two terminal ones, against a flat gasket which abuts against the front surface of the sleeve. The tightness of these connections, however, is not perfect, especially in the presence of negative pressure in the tubes, because the sealing surface is limited to the region of front mating between the tubes to be joined and because said surface, due to the pack-like deformation of the undulations of the flexible tube, is not flat and uniform enough and thus such as to ensure correct mating.

Particularly, the forming of a flat front mating surface by compressing the undulations is not possible if said undulations are helical, therefore these known connections cannot be used for flexible tubes with undulations of this type.

Furthermore, even in said known connections the region of contact between the protruding ring of the bush which deforms the undulations of the tube and the tube itself is very limited, so that a high concentration of stresses forms during tightening, and this on one hand can create tears in the sheet metal of the undulated tube and on the other hand can produce permanent deformations of the gasket when, in an attempt to ensure tightness, the ring which pulls said bush is tightened excessively.

Another problem of the above known connections resides in the fact that it is not possible to use standard torus-like gaskets which, by deforming, would prevent or at least compromise the necessary pack-like compression of said terminal undulations of the tube.

The aim of the present invention is to eliminate the above-mentioned problems and within the scope of this general aim said invention has the object of providing a coupling device, herein termed connection, for undulated flexible tubes which is suitable to ensure perfect tightness of said connection by virtue of the fact that the sealing surface is not only frontal but is also extended to a significant portion of the lateral surface of the undulated flexible tube.

Another object of the invention is to provide a connection wherein the pack-like compression of the undulations of the flexible tube is not required and in which, therefore, it is possible to use both elastomer and metal (copper) standard torus-like gaskets.

A further particular object of the present invention is to provide a coupling device which has a very simplified structure which can be substantially reduced to just two parts and is suitable to connect both flexible tubes with parallel undulations and flexible tubes with helical undulations.

In order to achieve this aim, these objects and others which will become apparent hereinafter from the following detailed description, the present invention relates to a device for the quick coupling of unbraided flexible metal tubes to rigid tubes, unions and the like, whose essential characteristic resides in the fact that it comprises a sleeve which can be associated with the rigid tube or union and at least one ring which can be associated with the flexible tube, a threaded coupling on said sleeve and said ring to mutually connect them and force them axially against each other, a series of annular protrusions which are associated with the ring and protrude radially toward the axis of said ring to engage respective grooves which separate corresponding undulations of the flexible tube and to push the undulated flexible tube into forced contact engagement against said sleeve when the threaded coupling is tightened by turning the ring with respect to said sleeve; said annular protrusions associated with the ring having a profile which is shaped complementarily to the profile of the grooves which separate the undulations of the flexible tube.

According to an embodiment of the invention, the annular protrusions which are meant to engage the grooves of the flexible tube are provided directly on the inner surface of the ring and the ring is formed by two portions which are separated along a diametrical plane so that it can be fitted on the undulated tube.

According to a further embodiment of the invention, the ring is cylindrical and acts on an intermediate annular element which is provided with the annular protrusions and is produced in two parts which are separated along the diametrical plane.

Further characteristics and advantages will become apparent from the following detailed description and with reference to the accompanying drawings, provided by way of non-limitative example, wherein:

figure 1 is a partially sectional elevation view of the coupling device according to an embodiment of the invention;

figure 2 is a partial sectional view, similar to figure 1, illustrating a further embodiment related to the sealing system;

figure 3 is a partial sectional view, similar to the preceding ones, illustrating a further embodiment with an intermediate annular element associated with the ring;

figures 4 to 9 are partial sectional views, similar to the preceding ones, illustrating respective variations of the intermediate annular element;

figure 10 is a perspective view of a preferred embodiment of the intermediate annular element of figures 6 to 9.

Initially with reference to figure 1, the reference numeral 10 designates the flexible metal tube, of the type which comprises undulations 11 which are separated by parallel or helical grooves 12. The reference numeral 13 generally designates the device according to the invention, which is suitable to provide the tight and weld-free quick-coupling of the tube 10 to a rigid tube or union, not shown in the figure.

The device 13 is substantially constituted by a sleeve 14 which is meant to be connected to the rigid tube or sleeve and by a ring 15 which is meant to be associated with the flexible tube 10; the ring is metallic or made of a high-strength polymeric material.

Correspondingly threaded portions 16 are provided on the sleeve 14 and on the ring 15 and allow to mutually connect said sleeve and said ring and force them axially against each other; the ring is provided with a hexagonal outer surface 15a for the engagement of a wrench for tightening.

Two or more annular protrusions 17 are provided on the inner surface of the ring 15 and protrude radially toward the axis of said ring to engage respective grooves 12 which separate corresponding undulations 11 of the tube 10.

For this purpose, the annular protrusions 17 have, in cross section, a profile which is complementary to the profile of the grooves 12, so as to couple with them with minimal play. So that it can be fitted on the tube 10, the ring 15 is made of two parts which can be juxtaposed along a diametrical plane.

The sleeve 14 has a terminal cup-shaped seat 18 which receives the ring 15 and is provided with the internal thread portion which is meant to engage the corresponding thread portion of the ring. An abutment 19 is formed on the bottom of the cup 18 for an elastomer gasket 20 of the known type which has a torus-like profile. Using a gasket of this type, the tube 10 is sectioned at a groove and thus forms a terminal curl 21 which cooperates to the centering and radial retention of the gasket. The device is installed by fitting the two portions of the ring 15 on the tube 10 --the engagement of the

protrusions 17 with the grooves 12 ensuring the perfect alignment of said portions -- and by screwing the ring thus composed into the seat 18, after inserting the elastomer gasket 20 in said seat. During the tightening of the ring, the last undulation of the tube deforms elastically and ensures a perfect tight contact between said tube and the gasket. The tightening of the ring is limited by an abutment 15a of said ring and stops when said abutment makes contact with the bottom of the seat 18. This configuration is matched by preset elastic deformations of the terminal undulation of the tube 10 and of the gasket 15 which are suitable to ensure a correct sealing action.

The further embodiment shown in figure 2 differs in that the gasket 20 is suppressed and that a rising annular protrusion 22, or a conical surface, is provided on the bottom of the cup-shaped seat 18 and is meant to directly engage the sheet metal of the tube 10 to provide a sealing action.

As clearly shown in the figure, in this case the tube 10 is sectioned at an undulation, so that the terminal undulation of the tube becomes interposed between a protrusion 17 of the ring and the rising protrusion 22 and, by tightening the ring, the protrusion 17 forces the terminal undulation against the protrusion 22, ensuring tightness.

In the further embodiment shown in figure 3, the ring 150 is cylindrical and acts, with a collar 151, on an intermediate annular element 152 which is formed of two parts which can be arranged face to face and is provided with the protrusions 170 which are meant to couple with the grooves 12 of the tube 10. The tube 10 is sectioned at a groove 12 and cooperates with a torus-like elastomer gasket 200 which is fitted on a terminal tang 141 of the sleeve 140. A step 142 is also defined on said sleeve and is meant to be engaged by a corresponding abutment 153 of the intermediate annular element 152.

The further embodiment shown in figure 4 differs in that the intermediate annular element 152 is provided with a single protrusion 170 and in that the tube 10 is sectioned at an undulation.

In the further embodiment shown in figure 5, the tube is sectioned at a groove 12 and the elastomer gasket 200 is tightly coupled, for example vulcanized, to a metallic annular support 201, for example made of copper, which also acts as gasket centering element.

In the variations of figures 6 to 9, particularly suitable for tubes with helical undulations, the intermediate annular element 252 with the protrusions 270 is made, fully or partially, of elastomer material, for example hard rubber, and is forced and compressed between the ring 250 and an abutment surface 241 of the sleeve 240 or between at least one metallic portion 253 of the intermediate annular

element and said abutment of the sleeve (figure 7); the metallic portion or portions and the elastomer one are preferably coupled by vulcanization. In both cases, the axial extension of the intermediate annular element 252 is chosen so that at least the terminal undulation of the flexible tube, which faces the sleeve, is not embraced by the ring, i.e. is external thereto.

In the embodiment of figure 8, the intermediate annular element 252 is provided with a single annular protrusion 270 interposed between the last undulation of the tube 10 and the abutment surface 241 of the sleeve 240; the tube 10 is sectioned at a groove 12.

In figure 9, the elastomer portion of the intermediate annular element 252 is comprised between two metallic portions 253, and in this case, too, as in the case of figure 6, the overall axial extension of the annular element is such that the terminal undulation of the tube, which faces the sleeve 240, is not embraced by the annular element 252; the metallic portion 253 directed toward the sleeve is in contact with the abutment surface 241 of the sleeve 240.

The intermediate annular elements 252 of figures 6 to 9 are advantageously produced as shown in figure 10, wherein it can be seen that the two parts 252a-252b of the annular element are connected by a thin film 260 defined in the elastomer portion. The film 260 acts as a hinge which allows to mutually divaricate the two parts 252a-252b of the annular element so as to allow to fit said annular element on the tube. At the same time, said film 60 allows to keep the two parts of the annular element mutually connected, facilitating storage and use of said annular element when it is not used.

In practice it has thus been observed that the above described device has achieved the intended aim and objects of the present invention.

The invention thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept.

All the details may furthermore be replaced with other technically equivalent elements.

In practice, the materials employed, so long as they are compatible with the contingent use, as well as the dimensions, may be any according to the requirements.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Device for the quick-coupling of unbraided flexible metal tubes (10), of the type with parallel or helical undulations (11), to rigid tubes, unions and the like, characterized in that it comprises a sleeve (14-140) which can be associated with the rigid tube or union, and at least one ring (15) which can be associated with the flexible tube, a threaded coupling (16) on said sleeve and said ring to mutually connect them and force them axially against each other, one or more annular protrusions (17) which are associated with the ring and protrude radially toward the axis of said ring to engage respective grooves (12) which separate corresponding undulations (11) of the flexible tube and to push the undulated flexible tube into forced contact engagement against said sleeve (14-140) when the threaded coupling (16) is tightened by turning the ring with respect to said sleeve; the annular protrusion or protrusions (17) associated with the ring having a profile which is shaped complementarily to the profile of the grooves (12) which separate the undulations (11) of the flexible tube.
2. Device according to claim 1, characterized in that the annular protrusions (17) intended to engage the grooves (12) of the flexible tube are provided directly on the inner surface of the ring (15) which is directed toward the flexible tube (10) and in that the ring is formed by two portions which can be juxtaposed along a diametrical plane.
3. Device according to claims 1 and 2, characterized in that the ring (15) is metallic.
4. Device according to claims 1 and 2, characterized in that the ring (15) is made of polymeric material.
5. Device according to claims 1, 2 and 3 or 4, characterized in that a torus-like elastomer or metal gasket (20-200) is interposed between the end of the flexible tube (10) and the sleeve (14) and reacts against an abutment surface (19) of the sleeve (14), and in that the undulated tube is sectioned at a groove so as to form an end curl (21) which cooperates to the centering and retention of the gasket.
6. Device according to claims 1 and 2, 3 or 4, characterized in that the abutment surface (19) of the sleeve (14) has a rising annular protrusion (22) which directly engages the sheet metal of the tube (10), which is sectioned at an

undulation (11); the terminal undulation of the tube being interposed between a terminal protrusion (17) of the ring and said rising protrusion (22) of the sleeve (14).

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7. Device according to claims 5 or 6, characterized in that the abutment surface (19) of the gasket or the rising protrusion (22) are defined on the bottom of a terminal cup-like seat (18) of the sleeve.

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8. Device according to claim 1, characterized in that the ring (150) is cylindrical and cooperates with an intermediate annular element (152) which is formed by two juxtaposable annular element parts and provided with at least one internal radial protrusion (170) which is suitable to engage a corresponding groove (12) of the flexible tube (10); the ring (150) being provided with a collar (151) suitable to engage said intermediate annular element (152).

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9. Device according to claims 1 and 8, characterized in that said intermediate annular element (152) is at least partially made of elastomer material, and is forced and compressed between the ring (150) and an abutment surface (241) of the sleeve (240).

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10. Device according to claim 9, characterized in that the intermediate ring (252) is formed by metal portions (253) and elastomer portions.

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11. Device according to claim 9, characterized in that the axial extension of the intermediate annular element (252) is chosen so that at least the terminal undulation (11) of the flexible tube (10) which faces the sleeve (240) is external to said intermediate annular element (252).

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12. Device according to claims 9 and 10, characterized in that the elastomer portion of the intermediate annular element (252) is provided with a single annular protrusion (170) and in that said protrusion is interposed between the last undulation of the flexible tube (10) and the abutment surface (24) on the sleeve (240).

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13. Device according to claim 8 and any one of claims 9 to 12, characterized in that the juxtaposable annular element parts (252a-b) are connected by a thin film (260) defined in the elastomer portion of said annular element parts and in that said film (260) acts as element for connecting said parts and as a hinge which allows to mutually divaricate said parts to fit said annular element (252) on the tube.

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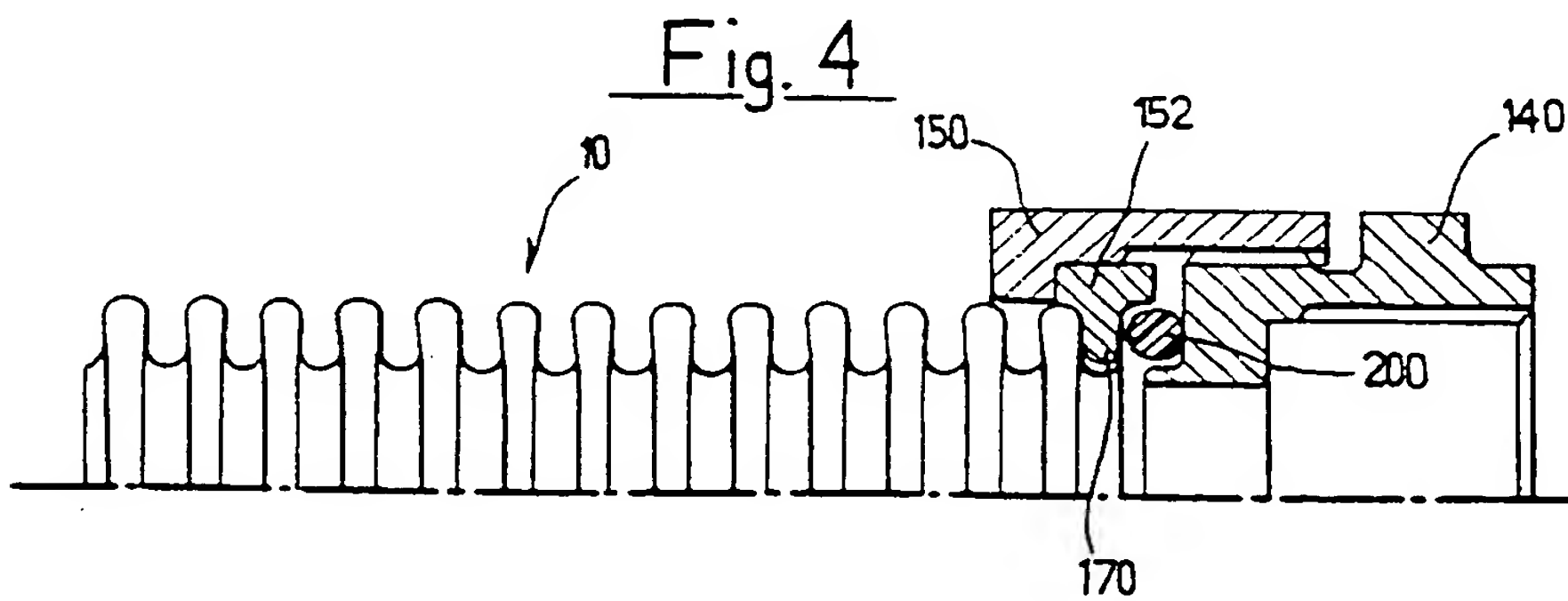
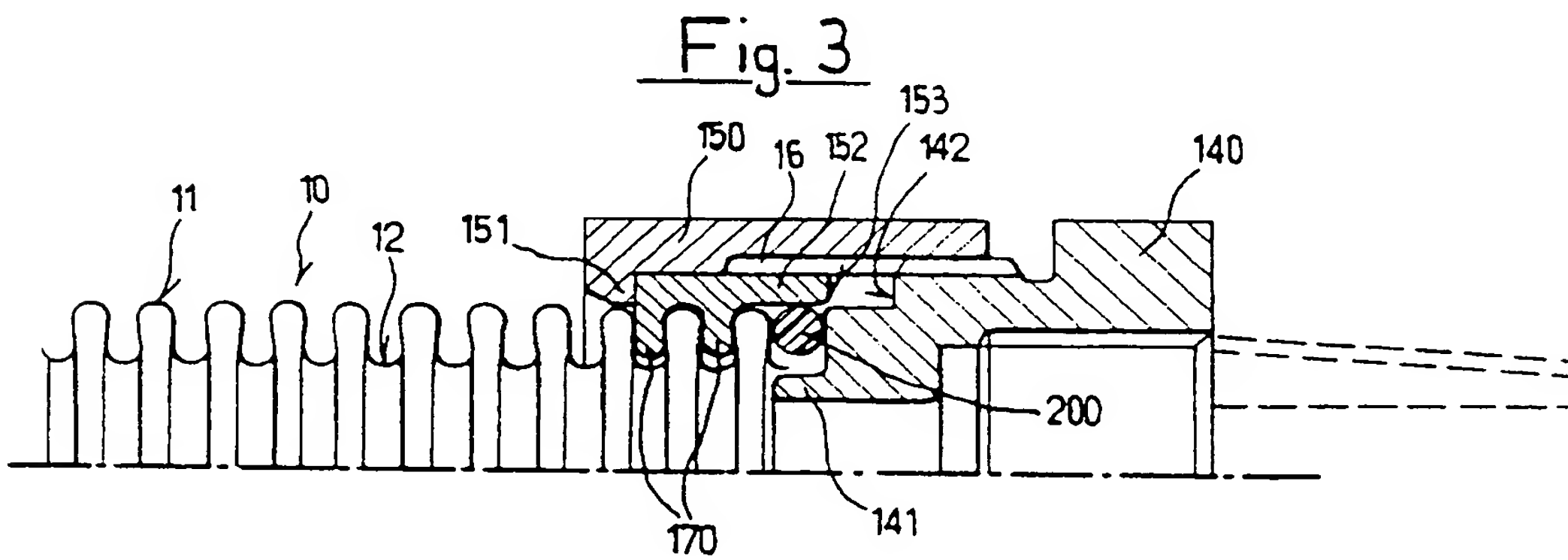
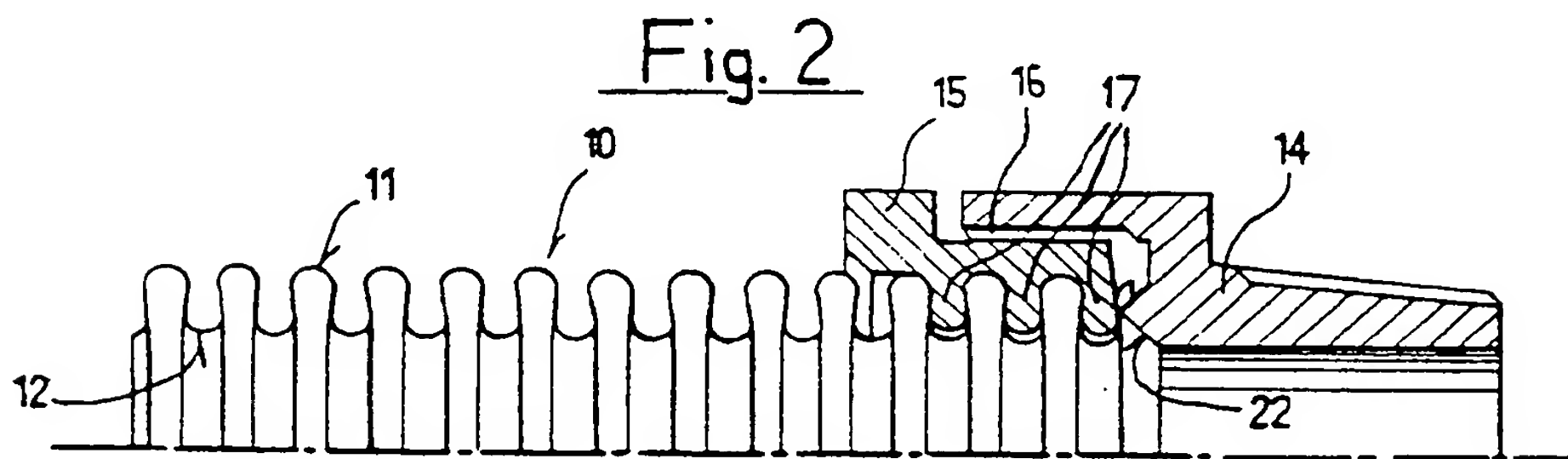
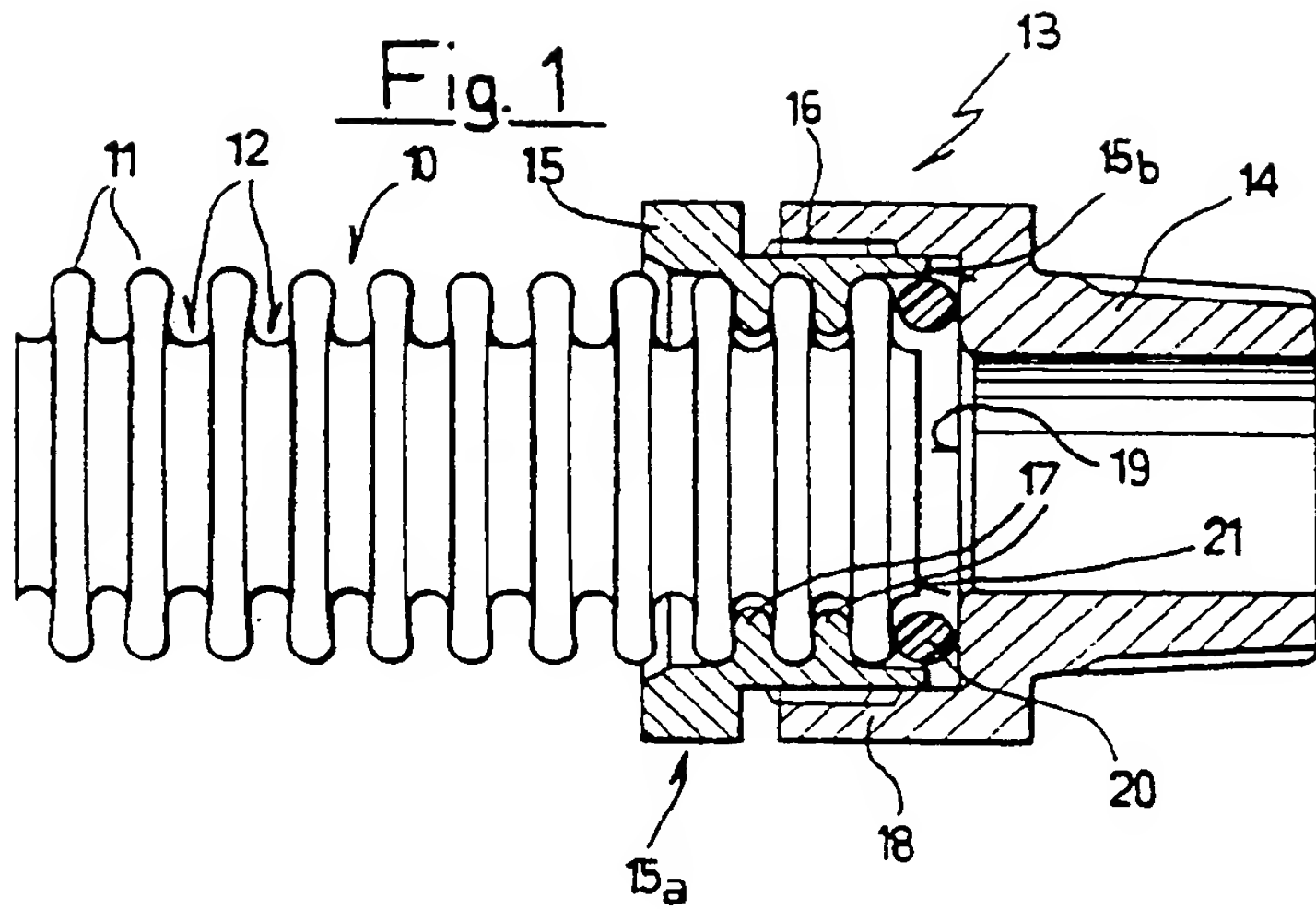


Fig. 5

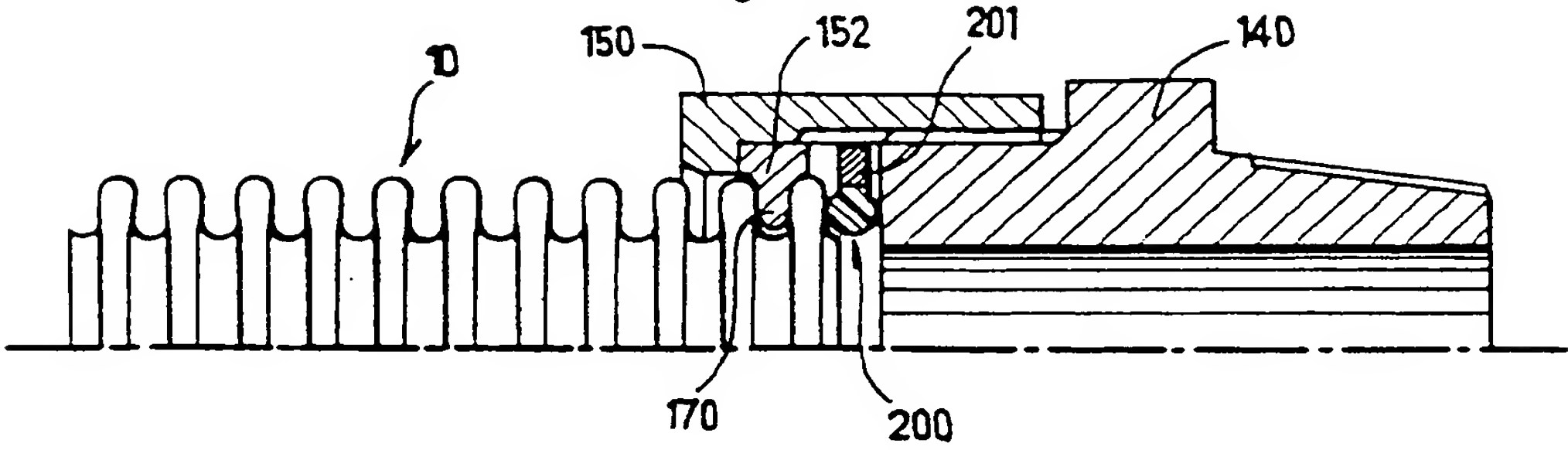


Fig. 6

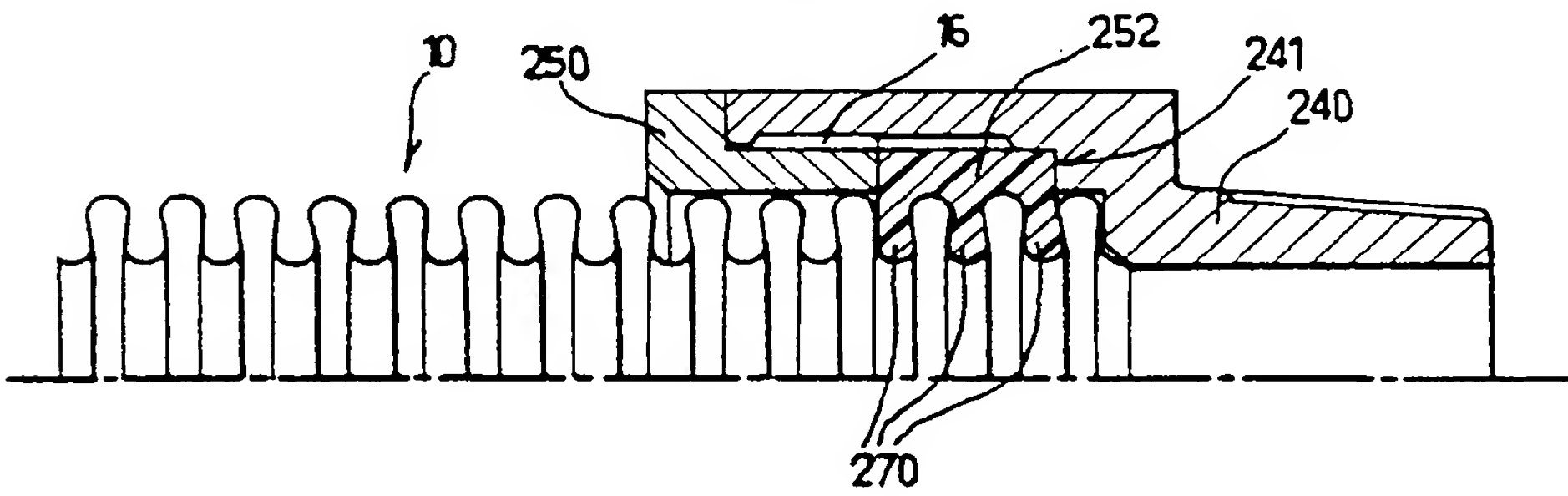


Fig. 7

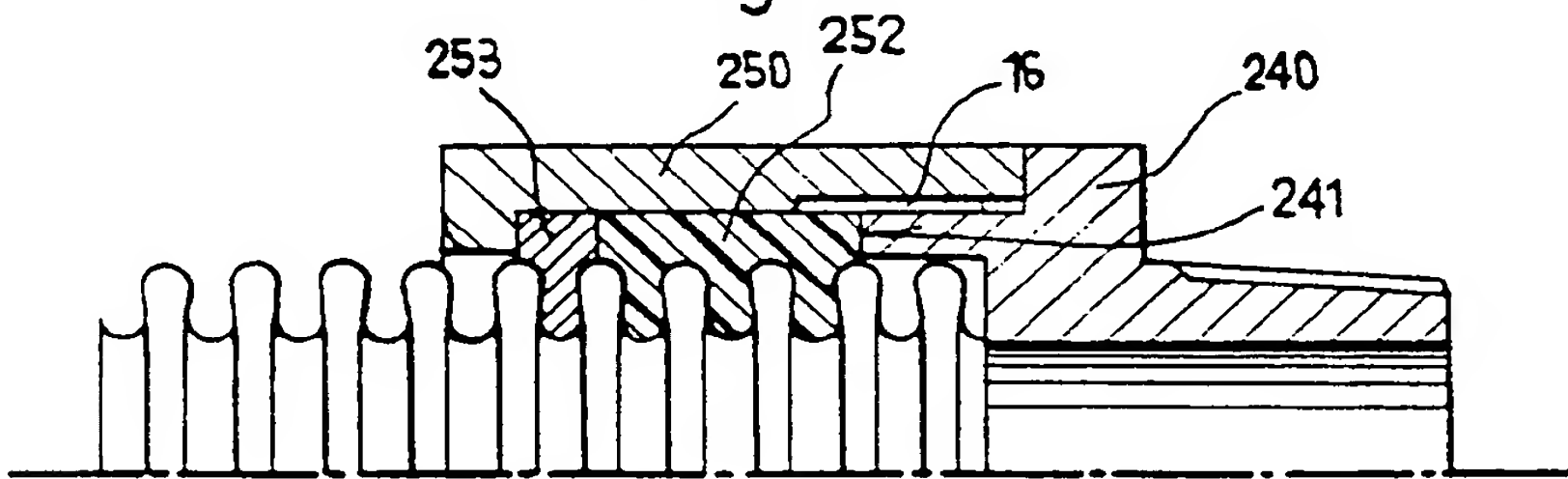


Fig. 8

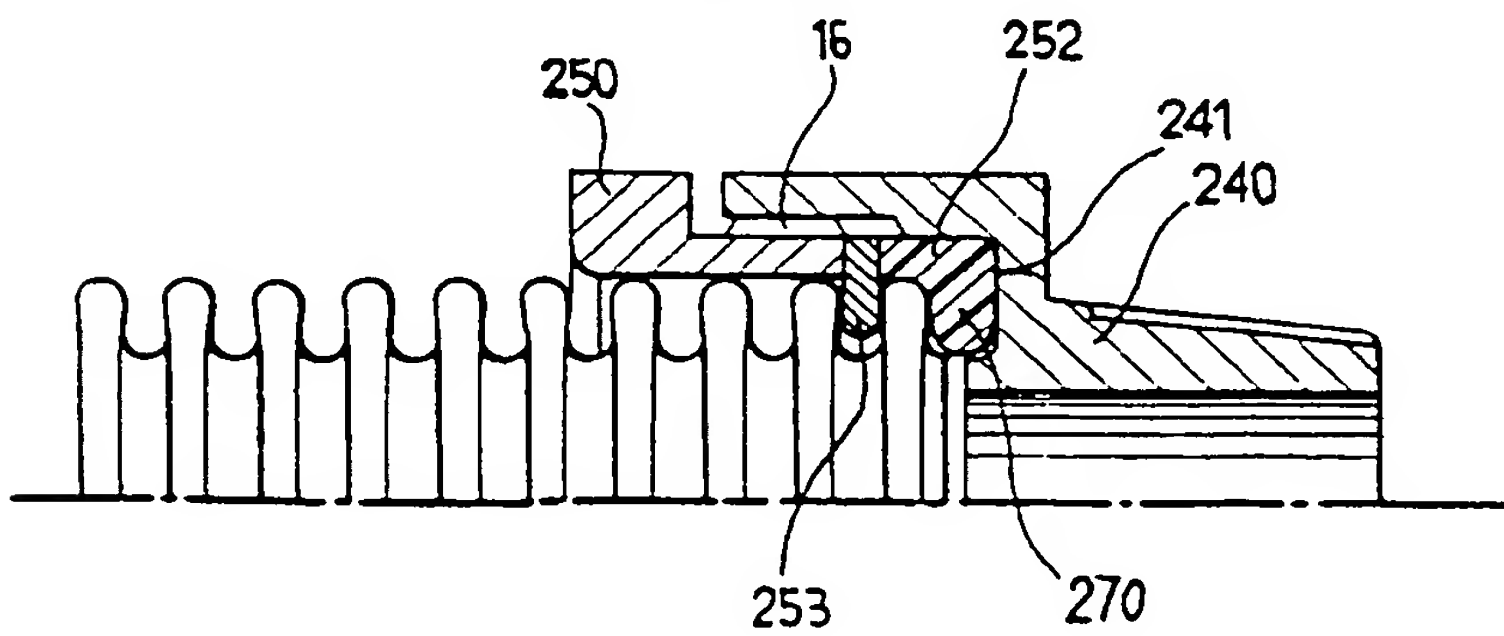


Fig. 9

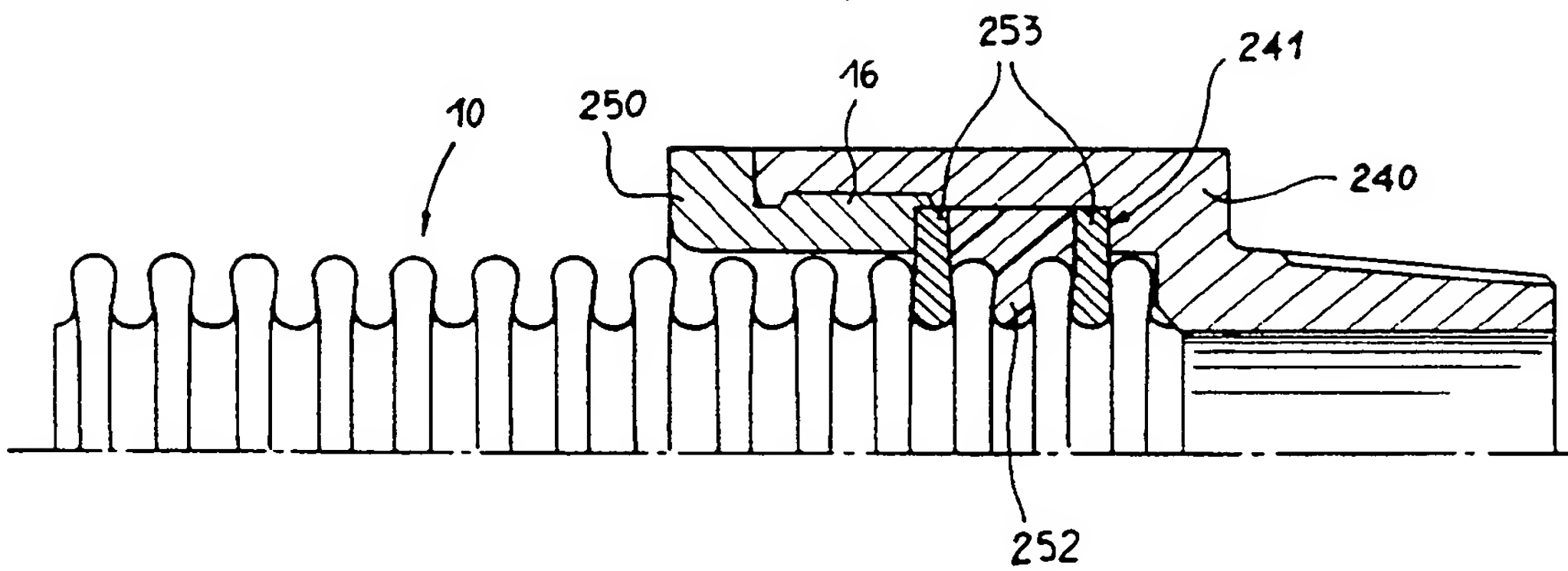
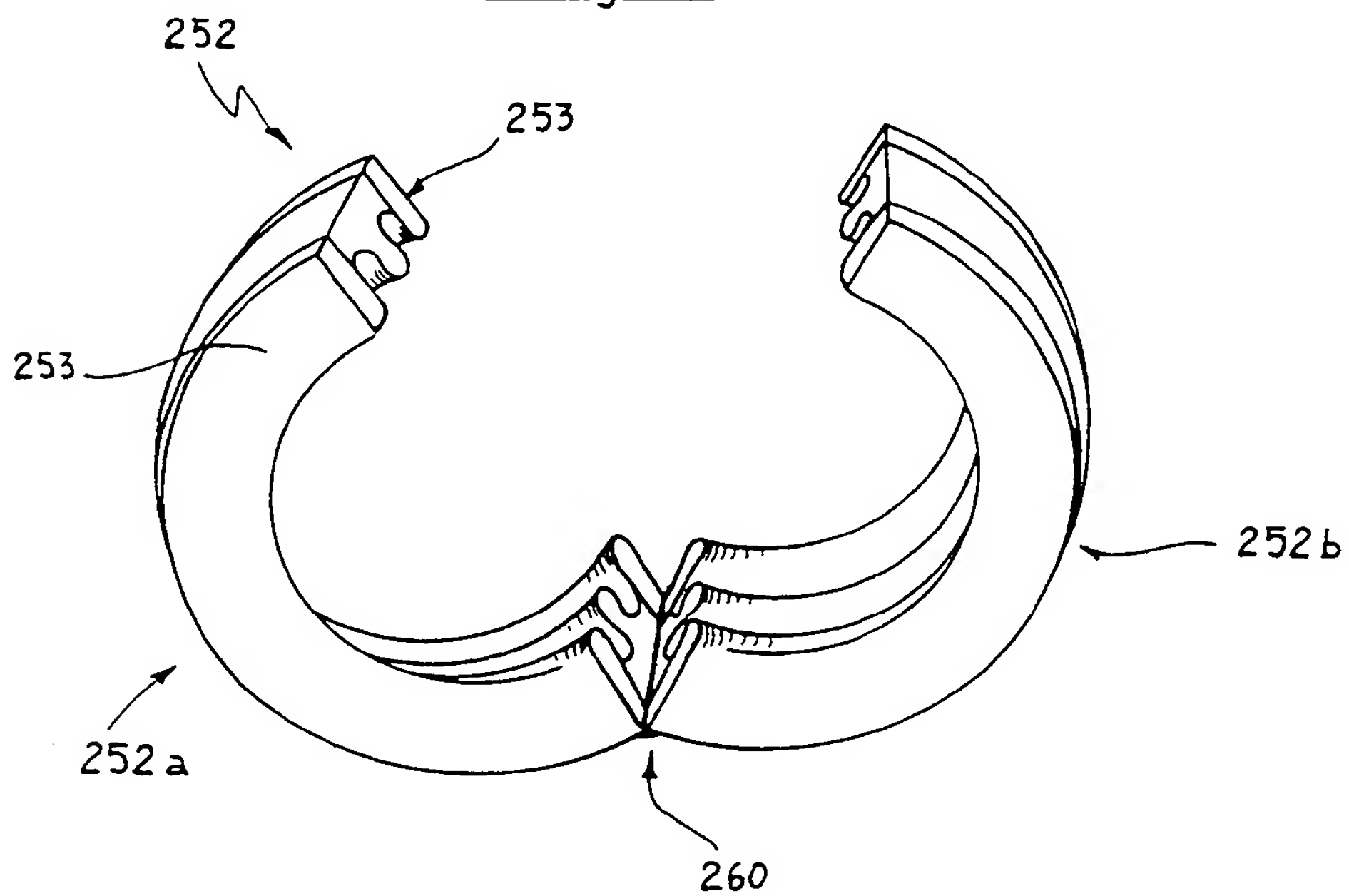


Fig. 10





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EUROPEAN SEARCH REPORT

Application Number

EP 92 12 0646

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 630 850 (SAKA) * the whole document *	1-4, 8	F16L33/26 F16L25/00
A	---	5, 12, 13	
X	FR-A-1 286 787 (MANUFACTURE DE CAOUTCHOUC ET D'EBONITE PAUL JEANTET) * the whole document *	1-4, 8-10	
X	US-A-4 437 691 (LANEY) * the whole document *	1-5, 8, 9	

			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F16L
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25 MARCH 1993	Examiner ANGIUS P.
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